Appendix I

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Title of Invention: **Deodorant**

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Specifications

1. Title of Invention:

   Deodorant

2. Scope of Patent Claims:

   A deodorant, characterized in that an acidic metal salt is compounded with an organic acid with a high acidity.

3. Detailed Description of the Invention:

Field of Use in Industry

This invention concerns a deodorant; more specifically, it concerns a chemical deodorant for eliminating general odors produced in homes and offices.

Prior Art

In recent years, air conditioning equipment has become common in houses, etc., as they have become more air-tight, and odors produced in homes and offices has become a problem. Various measures have been taken to eliminate these odors.

Masking and physical adsorption have been widely used up to now as methods for eliminating these odors.

The masking method does not actually remove the odor-causing substance, but diminishes the odor or covers it with a stronger odor by the presence of a second substance.

This method is widely use, especially in preventing odors in toilets, but it has the problems that there are great differences among individuals in the odors of the second masking substances that they find desirable and in the persistence of the effectiveness of the method.

Next, the physical adsorption method adsorbs the odorous substance physically by using an adsorbent such as activated carbon, zeolites, etc., and is widely used in refrigerators, automobiles, etc.

This method has the drawbacks that the ability to adsorb ammonia, a common odor-causing ingredient in homes, is low, the adsorptive power is reduced by the absorption of moisture, or the re-release of the adsorbed substances is a concern.

Thus, the deodorizing methods of the prior art have various drawbacks and it is difficult to eliminate odors effectively. Recently, chemical treatment methods, which decompose and remove odors by using chemical reactions, have come into use.

In chemical treatment methods, various chemical substances, such as ferric compounds, potassium permanganate, chlorine compounds, etc., which react chemically with ammonia, amines, hydrogen sulfide, etc., which are common odor-causing ingredients and convert them to odorless substances, have been used.

Problems Which the Invention Seeks to Solve

However, conventional deodorizing methods which use chemical substances have had various drawbacks, in that the reactivities of these substances with the odor-causing substances are low, and sufficient decomposition has not been performed; the reaction rates are slow, and time is required for the decomposition; and their stabilities are poor. Thus, they have not been able to eliminate odors effectively.

This invention was made with this situation in mind, as a result of diligent investigations into the development of stable chemical deodorants which could rapidly and effectively decompose odor-causing substances.

Means for Solving These Problems

That is, this invention is a deodorant which is characterized by the fact that an acidic metal salt is compounded with an organic acid with a high acidity.

Action of the Invention

The deodorant of this invention has the effect of promoting and stabilizing the reactions due to the fact that strong acids produced by the hydrolysis of acidic metal salts and weak bases are co-present with strongly acidic organic acids, the ingredients [of the invention] react with basic or acidic odor-causing ingredients, such as ammonia, amines, hydrogen sulfide, etc., and deodorize them; hydrolysis of the metal salts by the organic acids and formation of complex salts are promoted.

Working Examples

Working Example 1

After 1 liter of an aqueous solution of oxalic acid (30 w/v%) and 1 liter of an aqueous solution of zinc chloride (15 w/v%) were thoroughly stirred and mixed, this mixture was impregnated into granular activated carbon (Nihon Carbon Co., ACG-AM). Next, heating and drying were performed in a vacuum (10 mmHg, 100°C), and a sample in which a deodorant was supported on activated carbon was obtained.

The results of comparing the deodorizing power of this sample with those of activated carbon and zeolite are shown in Table 1.

Table 1

Odor-causing substance / Sample	Ammonia	Hydrogen sulfide	Trimethylamine
Working Example 1		O	
Activated carbon			O
Zeolite	O		O

Excellent; O good; allowable; not allowable

Working Example 2

After 1 liter of an aqueous solution of oxalic acid (30 w/v%) and 1 liter of an aqueous solution of zinc sulfate (5 w/v%) were thoroughly stirred and mixed,

this solution was absorbed by Japanese paper, after heating and drying were performed in a vacuum in the same manner as in Working Example 1, and a deodorant paper was formed.

The deodorant performance of the deodorant paper formed in this manner was found to be excellent, as in the case of the deodorant supported on activated carbon of Working Example 1.

To explain the make-up of this invention in further detail, deodorizing by means of various kinds of acids was first attempted, since alkaline ingredients such as ammonia and amines are frequently found in common odor-causing substances, but since inorganic acids had various problems, such as the production of stable irritating odors, it was found desirable to use odorless organic acids.

As these organic acids, the deodorizing efficacies of dibasic acids, such as malonic acid, oxalic acid, fumaric acid, succinic acid, and maleic acid, amino acids, such as aspartic acid, glycine, alanine, glutamine, etc., and oxy acids, such as citric acid, gluconic acid, glycolic acid, malic acid, salicylic acid, tartaric acid, etc., were investigated. As a result, it was found that the deodorizing efficacies of the organic acids were related to their acidities, and those of highly acidic ones, such as oxalic acid and maleic acid, were especially good.

However, although the deodorizing efficacies of highly acidic organic acids such as oxalic acid and maleic acid, mentioned above, against alkaline ingredients such as ammonia and amines were excellent, their efficacies against acidic ingredients such as hydrogen sulfide were poor. Therefore, acidic metal salts were next added to the composition, in order to improve the deodorizing efficacy against alkaline ingredients further and to impart a deodorizing efficacy against acidic ingredients.

These acidic metal salts are salts of metals which are bivalent or higher, such as Al, Zn, Mn, Fe, Cu, Ni, Co, Pb, Sn, etc., and strong inorganic acids such as sulfuric acid, nitric acid, hydrochloric acid, etc.

These salts absorb moisture in the air and hydrolyze, producing strong acids such as sulfuric, nitric, or hydrochloric acid and weak bases, which are hydroxides of the bivalent or higher metals mentioned above. The strong acids react with the alkaline ingredients, such as ammonia, amines, etc., in the odor-causing substances and the weak bases react with the acidic ingredients, such as hydrogen sulfide, in these substances, making them odorless.

Although the acidic metal salts all have the effect of eliminating odors, as mentioned above, it is necessary to consider also their chemical stabilities, toxicities, costs, etc. From this point of view, it is desirable to use zinc salts, such as $ZnSO_4$, $Zn(NO_3)_2$, $ZnCl_2$, etc., as the acidic metal salts.

Therefore, as the make-up of this invention, it is most desirable to use oxalic acid or maleic acid as the highly acidic organic acids, and compound sulfuric acid, nitric acid, or hydrochloric acid salts of zinc with them.

Next, Table 2 shows the relationships between the composition ratios of the aforementioned organic acids and zinc salts and the deodorizing efficacy.

Table 2

Deodorant composition ratio		Odor absorption rate (%)	
Oxalic acid	Zinc chloride	NH_3	H_2S
0	1.0	44	40
0.1	0.9	48	40
0.2	0.8	60	40
0.3	0.7	69	46
0.4	0.6	75	50
0.5	0.5	78	55
0.6	0.4	95	9
0.7	0.3	95	92
0.8	0.2	95	92
0.9	0.1	100	94
1.0	0	50	10

As shown in Table 2, although some deodorant efficacy was observed when the oxalic acid or the zinc chloride were used alone, superior efficacies against both the alkaline ammonia and the acidic hydrogen sulfide were shown with the synergistic effect obtained by using both of them together.

As is also clear from this table, especially good deodorizing efficacies are shown with specific composition ratios of the oxalic acid and zinc chloride; therefore, it is desirable for the quantity of zinc chloride in the composition to be in the range of 10-40%.

Finally, there are no particular limits on the forms in which the deodorant is used; one can conceive of aqueous solutions of specific quantities of the organic acid and acidic metal salt, powders obtained by heating and drying these aqueous solutions in a vacuum, adsorbed bodies, obtained by impregnating the aqueous solutions into porous substances such as activated carbon, zeolites, paper, cloth, etc., and then heating and drying them in a vacuum.

Among these forms in which the deodorant can be used, the form in which it is adsorbed on activated carbon, zeolites, etc., is desirable for application in home air conditioners; in this case, the quantity adsorbed is preferably about 10-20 wt% of the activated carbon or zeolites.

This is because a very excellent deodorizing efficacy can be exhibited by also exhibiting the physical adsorption ability of the activated carbon or zeolites which is the support of the deodorant.

Effect of the Invention

The deodorant of this invention has the make-up and action described above; its effect is to effectively deodorize both alkaline ingredients, such as ammonia and amines, and acidic ingredients, such as hydrogen sulfide; it is also chemically stable and exhibits its effect over a long period of time.

Therefore, if the deodorant of this invention is adsorbed on activated carbon or zeolites, it provides a deodorant which has the physical deodorant effectiveness of these substances in addition to the chemical deodorizing effect of the deodorant of this invention, and thus is an excellent deodorant for purifying home air.

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